

**What is claimed:**

1. An array antenna apparatus comprising:  
a plurality of antenna elements;  
power amplifiers respectively connected to the plurality  
of antenna elements;  
an amplitude phase distortion adding section positioned  
on at least any of a plurality of antenna arrays having the  
antenna elements and power amplifiers, to compensate for a  
nonlinear distortion in amplitude and phase occurring in the  
power amplifier;  
any one of an amplitude distortion adding section for  
compensating for an amplitude nonlinear distortion, occurring  
in the power amplifier, and a phase distortion adding section  
for compensating for a phase nonlinear distortion, positioned  
on any of the antenna arrays other than the antenna arrays having  
the amplitude-phase distortion adding section; and  
an amplitude-phase control section for controlling an  
amplitude weighting amount and phase rotation amount on a  
transmission signal based on each antenna array, in order to  
beam-control in a designated direction.
2. An array antenna apparatus according to claim 1,  
wherein the amplitude-phase distortion adding section is  
connected on an antenna array with the amplitude weighting  
amount equal to or greater than a predetermined value, any one  
of an amplitude distortion adding section and a phase distortion  
adding section being connected on an antenna array with the  
amplitude weighting amount smaller than the predetermined  
value.
3. An array antenna apparatus according claim 1, wherein  
the amplitude-phase distortion adding section is connected on

an antenna array having a distortion occurring in the power amplifier equal to or greater than a predetermined value, any one of an amplitude distortion adding section and a phase distortion adding section being connected on an antenna array having a distortion occurring in the power amplifier smaller than the predetermined value.

4. An array antenna apparatus according to claim 2, wherein the amplitude-phase distortion adding section is connected on an antenna array having a distortion occurring in the power amplifier equal to or greater than a predetermined value, any one of an amplitude distortion adding section and a phase distortion adding section being connected on an antenna array having a distortion occurring in the power amplifier smaller than the predetermined value.

5. An array antenna apparatus comprising:  
a plurality of antenna elements;  
power amplifiers respectively connected to the plurality of antenna elements;  
an amplitude-phase control section for controlling an amplitude weighting amount and phase rotation amount on a transmission signal based on each of a plurality of antenna arrays having the antenna element and power amplifier, in order to beam-control in a designated direction; and  
an instantaneous power level computing section for computing an instantaneous power level of a signal inputted to the plurality of antenna arrays;  
whereby the amplitude-phase control section corrects for the amplitude weighting amount and phase rotation amount depending upon an instruction from the instantaneous power level computing section.

6. An array antenna apparatus according to claim 5, wherein the correction is carried out on the basis of a correction table, including a compensation for a nonlinear distortion due to the power amplifier, that the instantaneous power level computing section designates according to the instantaneous power level and a beam-direction control signal to designate a beam direction to the amplitude-phase control section.

7. An array antenna apparatus comprising:

- a plurality of antenna elements;
- a plurality of power amplifiers respectively connected to the plurality of antenna elements;
- a distortion adding section positioned on a plurality of antenna arrays having the antenna element and the power amplifier, to compensate for a nonlinear distortion occurring in the power amplifier;
- an amplitude-phase control section for controlling, based on each antenna array, an amplitude weighting amount and phase rotation amount in order to beam-control in a designated direction;
- whereby the distortion adding section is configured by using a reconfigurable device (rewritable circuit), to rewrite a circuit configuration of the reconfigurable device according to the amplitude weighting amount and phase rotation amount.

8. An array antenna apparatus according to claim 7, wherein rewriting a circuit configuration of the reconfigurable device is switching between an antenna array where an amplitude-phase distortion adding circuit exists to compensate for a nonlinear distortion in amplitude and phase occurring in the power amplifier and an antenna array where any one of an

amplitude distortion adding circuit to compensate for a nonlinear distortion in amplitude occurring in the power amplifier and a phase distortion adding circuit to compensate for a nonlinear distortion in phase exists.

9. An array antenna apparatus according to claim 7, wherein the plurality of antenna elements configure a circular array antenna.

10. An array antenna apparatus according to claim 8, wherein the plurality of antenna elements configure a circular array antenna.

11. A radio communications apparatus having an array antenna apparatus according to claim 1.

12. A radio communications apparatus having an array antenna apparatus according to claim 2.

13. A radio communications apparatus having an array antenna apparatus according to claim 3.

14. A radio communications apparatus having an array antenna apparatus according to claim 5.

15. A radio communications apparatus having an array antenna apparatus according to claim 6.

16. A radio communications apparatus having an array antenna apparatus according to claim 7.

17. A radio communications apparatus having an array antenna apparatus according to claim 8.

18. A radio communications apparatus having an array antenna apparatus according to claim 9.

19. A MIMO communication apparatus comprising:  
a plurality of antenna elements;  
a plurality of power amplifiers respectively connected to each of antenna elements;

an amplitude phase distortion adding section for compensating for a nonlinear distortion in amplitude and phase occurring in the power amplifier;

a reconfigurable device (rewritable circuit) constituting any one of an amplitude distortion adding section to compensate for a nonlinear distortion in amplitude and a phase distortion adding section to compensate for a nonlinear distortion in phase, and positioned on each of the antenna arrays having the antenna element and the power amplifier;

an amplitude-phase control section for controlling an amplitude weighting amount and phase rotation amount on a transmission signal based on each antenna array, in order to beam-control in a designated direction and

a reception antenna for receiving a propagation environment signal to notify a propagation environment of a signal sent at the plurality of antennas;

whereby the amplitude weighting amount and phase rotation amount is determined according to a reception signal from the reception antenna, the amplitude-phase distortion adding section and any one of the amplitude distortion adding section and the phase distortion adding section being arranged according to the amplitude weighting amount and phase rotation amount.